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AUTHOR(S):

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CITATION:

表紙・目次. 数理解析研究所講究録 2005, 1447

ISSUE DATE:

2005-08

URL:

<http://hdl.handle.net/2433/47650>

RIGHT:

数理解析研究所講究録 1447

複素力学系  
Complex Dynamics

京都大学数理解析研究所

2005年8月

*RIMS Kokyuroku 1447*

*Complex Dynamics*

*August, 2005*

*Research Institute for Mathematical Sciences*

*Kyoto University, Kyoto, Japan*

# *Complex Dynamics*

RIMS, April 2003-March 2004

This volume is the proceedings of the special year "Complex dynamics" held at the Research Institute for Mathematical Sciences (RIMS), Kyoto University, from April 2003 through March 2004. This project was generously supported by

- Research Institute for Mathematical Sciences;
- 21COE Program "Formation of an International Center of Excellence in the Frontiers of Mathematics and Fostering of Researchers in Future Generations;"
- Japan Society for the Promotion of Science, Grants-in-Aid for Scientific Research #15340055, 2003-2006.

We would like to express our gratitude to the institutions which provided the support.

As one of the main activities of the project, we had the following conferences all held at RIMS, except the mini-workshop.

- "One-dimensional Complex Dynamics and Related Topics"  
July 1-4, 2003, Organizer: Mitsuhiro Shishikura (Kyoto University)
- "Complex dynamics in higher dimension"  
December 1-5, 2003, Organizer: Tetsuo Ueda (Kyoto University)
- "Topological and geometrical methods of complex differential equations"  
January 19-23, 2004, Organizer: Toshikazu Ito (Ryukoku University)
- Mini-workshop "Topics in Complex Dynamics" held at Department of Mathematics, Kyoto University, February 12-13, 2004,  
Organizer: Mitsuhiro Shishikura (Kyoto University)
- "Complex Dynamics"  
February 16-20, 2004, Organizer: Mitsuhiro Shishikura (Kyoto University)

This volume contains contributions from the participants of these conferences.

Supported by RIMS, there were visitors for extended periods.

- Charles Favre (CNRS and Universite de Paris VII, France)  
April 21-August 5, 2003
- Eric Bedford (Indiana University, USA)  
October 1-December 31, 2003
- John Smillie (Cornell University, USA)  
October 1-December 31, 2003
- Xavier Gomez-Mont (Centro de Investigacion en Matimaticas, Mexico)  
January 5-April 4, 2004
- Michael McQuillan (University of Glasgow, Scotland)  
Jan. 19-Feb. 21, 2004
- Weixiao Shen (University of Warwick, UK)  
Feb. 4-Mar. 12, 2004

A regular seminar on complex dynamics (including lectures by these visitors) was held in RIMS every Friday throughout the special year.

As a part of 21st Century COE program, an "Open School" was held in the Department of Mathematics, Kyoto University. It was aimed at undergraduate and graduate students and lectures were given by the participants of the Project, John Milnor (SUNY Stony Brook), Eric Bedford (Indiana University), John Smillie (Cornell University) and Mitsuhiro Shishikura.

Finally the organizers would like to thank all the participants of the activities of the project.

#### Organizers

Mitsuhiro Shishikura (Kyoto University, Chair)  
Shigehiro Ushiki (Kyoto University)  
Tetsuo Ueda (Kyoto University)  
Masahiko Taniguchi (Kyoto University)  
Isao Nakai (Ochanomizu University)  
Masato Tsujii (Hokkaido University)  
Masashi Kisaka (Kyoto University)  
Kyoji Saito (RIMS, Kyoto University)

# 1 次元複素力学系とその関連分野

One-dimensional Complex Dynamics and Related Topics

## 研究集会

京都大学数理解析研究所の共同研究事業の一つとして、下記のように研究集会を催しますので、ご案内申し上げます。

研究代表者 宋倉 光広 (京都大学 大学院理学研究科)

副代表者 木坂 正史 (京都大学 大学院人間・環境学研究科)

## 記

日時：2003年 7月 1日 (火) 13:30～

7月 4日 (金) 17:00

場所：京都大学数理解析研究所 4階420号室

京都市左京区北白川追分町 (市バス 京大農学部前 または 北白川 下車)

## プログラム PROGRAM

7月1日 (火) Tuesday, July 1

13:30～14:30 Shaun BULLET (Queen Mary, University of London, UK)

Dynamics of holomorphic correspondences

14:45～15:45 角 大輝 (東京工業大学・理) [Hiroki SUMI (Tokyo Institute of Technology)]

Dynamics of polynomial semigroups with bounded postcritical set in the plane

16:00～17:00 藤川 英華 (東京工業大学・理工) [Ege FUJIKAWA (Tokyo Institute of Technology)]

Iteration of an element of the Teichmüller modular group

7月2日 (水) Wednesday, July 2

9:45～10:45 Shaun BULLET (Queen Mary, University of London, UK)

Mating Chebyshev polynomials with Hecke groups

11:00～12:00 Xavier BUFF (Université Paul Sabatier, Toulouse, France)

The size of quadratic Siegel disks

13:30～14:30 奥山 裕介 (静岡大学・理) [Yusuke OKUYAMA (Shizuoka University)]

Nevanlinna and Diophantine theory in complex dynamics

14:45～15:45 稲生 啓行 (京都大学・理) [Hiroyuki INOU (Kyoto University)]

Homeomorphisms from Julia sets into connectedness loci

16:00~17:00 宍倉 光広 (京都大学・理) [Mitsuhiro SHISHIKURA (Kyoto University)]  
A priori bounds for parabolic renormalization

7月3日 (木) Thursday, July 3

9:45~10:45 Xavier BUFF (Université Paul Sabatier, Toulouse, France)  
Quadratic Siegel Disks with Smooth Boundaries

11:00~12:00 Charles FAVRE (CNRS, Univ. de Paris VII and RIMS)  
Dynamical degree for rational maps I

13:30~14:30 川平 友規 (京都大学・理) [Tomoki KAWAHIRA (Kyoto University)]  
Geometric limit and lamination

14:45~15:45 田中 泰浩 (University of Toronto, Canada) [Yasuhiro TANAKA]  
Cayley graphs in Laminations

16:00~17:00 宇敷 重廣 (京都大学・人間・環境) [Shigehiro USHIKI (Kyoto University)]  
Eigenfunctions of complex Ruelle-operators for hyperbolic rational maps and Artin-Mazur's zeta-function

7月4日 (金) Friday, July 4

9:45~10:45 Charles FAVRE (CNRS, Univ. de Paris VII and RIMS)  
Dynamical degree for rational maps II

11:00~12:00 Adam EPSTEIN (University of Warwick, UK)  
Polynomials with Parabolic Fixed Points: Ecalle-Voronin Invariants and Parameter Space Discontinuities I

13:30~14:30 泉 英明 (千葉工業大学・情報科学) [Hideaki IZUMI (Chiba Institute of Technology)]  
Iterative roots of exponential functions

14:45~15:45 諸澤 俊介 (高知大学・理) [Shunsuke MOROSAWA (Kochi University)]  
Dynamics of transcendental entire functions with two singular values

16:00~17:00 Adam EPSTEIN (University of Warwick, UK)  
Polynomials with Parabolic Fixed Points: Ecalle-Voronin Invariants and Parameter Space Discontinuities II

*This conference is a part of RIMS project "Complex Dynamics".*

# 高次元複素力学系

Complex dynamics in higher dimension

## 研究集会

京都大学数理解析研究所の共同研究事業の一つとして、下記のように研究集会を催しますので、ご案内申し上げます。この研究集会は、平成15年度数理解析研究所プロジェクト「複素力学系」の一環です。

研究代表者 上田 哲生 (京都大学 大学院理学研究科)

副代表者 宋倉 光広 (京都大学 大学院理学研究科)

### 記

日時：2003年12月 1日 (月) 14:30～

12月 5日 (金) 11:45

場所：京都大学数理解析研究所 1階115号室

京都市左京区北白川追分町 (市バス 京大農学部前 または 北白川 下車)

### プログラム PROGRAM

12月1日 (月) Monday, December 1

14:30～15:30 Eric Bedford (Indiana University, USA & RIMS)

Complex methods for real polynomial diffeomorphisms of the plane

16:00～17:00 石井 豊 (九州大学・数理) [Yutaka Ishii (Kyushu University)]

Hyperbolic polynomial diffeomorphisms of  $\mathbb{C}^2$

12月2日 (火) Tuesday, December 2

9:30～10:30 Chrales Favre (CNRS & Université de Paris VII, France)

Asymptotic degrees of rational maps

10:45～11:45 Romain Dujardin (Université de Paris VII, France)

Laminar currents and birational mappings I

13:30～14:30 John H. Hubbard (Cornell University, USA & Université de Provence, France)

Newton's method in 2 complex variables and matings

14:45～15:45 前川 和俊 (京都大学・入環) [Kazutoshi Maegawa (Kyoto University)]

Effects of indeterminacy points on Fatou sets

16:00～17:00 上田 哲生 (京都大学・理) [Tetsuo Ueda (Kyoto University)]

Simultaneous linearization of attracting and semi-attracting maps



12月3日 (水) Wednesday, December 3

- 9 : 30 ~ 10 : 30 John Milnor (State University of New York at Stony Brook, USA)  
Modified Desboves maps of  $\mathbb{P}^2$ , I. Dynamics
- 10 : 45 ~ 11 : 45 Araceli Bonifant (State University of New York at Stony Brook, USA)  
Modified Desboves maps of  $\mathbb{P}^2$ , II. The transverse Lyapunov exponent
- 13 : 30 ~ 14 : 30 Jeff Diller (Notre Dame University, USA)  
Birational surface maps with sparse post-critical sets
- 14 : 45 ~ 15 : 45 神 貞介 (京都大学・理) [Teisuke Jin (Kyoto University)]  
Yoccoz inequality for complex Hénon mappings
- 16 : 00 ~ 17 : 00 首藤 啓 (都立大学・理・物理) [Akira Shudo (Tokyo Metropolitan University)]  
Julia set describes quantum tunneling in the presence of chaos
- 18 : 00 ~ Reception がんこ高瀬川二条苑 (at Ganko Takasegawa Nijyoen)

12月4日 (木) Thursday, December 4

- 9 : 30 ~ 10 : 30 Jean-Yves Briend (Université de Provence)  
The linearity of the exceptional set
- 10 : 45 ~ 11 : 45 Marco Abate (Università di Pisa, Italy)  
Index theorems for holomorphic self-maps
- 13 : 30 ~ 14 : 30 篠原 知子 (都立高専) [Tomoko Shinohara (Tokyo Metropolitan College of Technology)]  
Horse shoe structure at a periodic indeterminate point of some birational mapping
- 14 : 45 ~ 15 : 45 三波 篤郎 (北見工業大学) [Atsuro Sannami (Kitami Institute of Technology)]  
Non-existence of finite-to-one symbolic representation for area preserving Henon map
- 16 : 00 ~ 17 : 00 角 大輝 (東工大・理) [Hiroki Sumi (Tokyo Institute of Technology)]  
Uniform perfectness of fiberwise Julia sets of fibered rational maps

12月5日 (金) Friday, December 5

- 9 : 30 ~ 10 : 30 John Smillie (Cornell University, USA & RIMS)  
Puzzles in two dimensions?
- 10 : 45 ~ 11 : 45 Romain Dujardin (Université de Paris VII, France)  
Laminar currents and birational mappings II

# 複素微分方程式の幾何学的研究

Topological and geometrical methods of complex differential equations

## 研究集会

京都大学数理解析研究所の共同研究事業の一つとして、下記のように研究集会を催しますので、ご案内申し上げます。この研究集会は、平成15年度数理解析研究所プロジェクト「複素力学系」の一環です。

研究代表者 伊藤 敏和 (龍谷大学 経済学部)  
副代表者 中居 功 (お茶の水女子大学 理学部)  
宋倉 光広 (京都大学 大学院理学研究科)

## 記

日時：2004年 1月19日 (月) 11:00～

1月23日 (金) 17:30

場所：京都大学数理解析研究所 1階115号室

京都市左京区北白川追分町 (市バス 京大農学部前 または 北白川 下車)

## プログラム PROGRAM

1月19日 (月) Monday, January 19

11:00～12:30 Xavier Gomez-Mont (CIMAT, México & RIMS)  
Geometry and dynamics of holomorphic flows I

14:00～15:30 Jorge Pereira (Universite de Rennes 1, France)  
Fibrations, divisors and transcendental leaves

16:00～17:30 Adolfo Guillot Santiago (UNAM, México)  
The geometry of Halphen's equations

1月20日 (火) Tuesday, January 20

9:30～11:00 Xavier Gomez-Mont (CIMAT, México & RIMS)  
Geometry and dynamics of holomorphic flows II

11:30～12:30 Isao Nakai (Ochanomizu Univ., Japan)  
Remark on a formula to compute holonomy

14:00～15:30 Alexey Glutsyuk (ENS Lyon, France)  
Instability of nondiscrete free subgroups in Lie groups

16:00～17:30 Frank Loray (Universite de Rennes 1, France)  
Algebraic Reduction Theorem for complex codimension one singular foliations

1月21日 (水) Wednesday, January 21

- 9:30~11:00 Marco Brunella (Universite de Bourgogne, France)  
Entire curves tangent to a foliation
- 11:30~12:30 Taro Asume (Kyoto Univ., Japan)  
Existence of transversely holomorphic structure of complex codimension one
- 14:00~15:30 Free discussion
- 16:00~17:30 Kazuo Okamoto (Univ. of Tokyo, Japan)  
Introduction to theory of the Painlevé equations I

1月22日 (木) Thursday, January 22

- 9:30~11:00 Kazuo Okamoto (Univ. of Tokyo, Japan)  
Introduction to theory of the Painlevé equations II
- 11:30~12:30 Kana Yanai (Ochanomizu Univ., Japan)  
Relations in  $\text{Diff}(\mathbb{C}, 0)$
- 14:00~15:30 Toshikazu Ito (Ryukoku University)  
A Poincaré-Hopf type theorem for holomorphic one-forms and its applications
- 16:00~17:30 Jorge Mozo (Univ. Valladolid, Spain)  
Multisummability for a class of singularly perturbed differential equations

1月23日 (金) Friday, January 23

- 9:30~11:00 Masatoshi Noumi (Kobe Univ., Japan)  
Discrete Painlevé equations and special functions
- 11:30~12:30 Tatsuo Suwa (Hokkaido Univ., Japan)  
Intersections, residue theorems on singular surfaces and applications
- 14:00~15:30 Filippo Bracci (Univ. di Roma "Tor Vergata", Italy)  
Splittings, Comfortably embedded subvarieties and index theorems
- 16:00~17:30 Michael McQuillan (University of Glasgow, Scotland)  
The importance of being Gorenstein

Mini-workshop:

## *Topics in Complex Dynamics*

February 12-13, 2004

Room 130, Department of Mathematics, Kyoto University

The workshop consists of two series of lectures:

- **Arnaud Chéritat** (Université Paul Sabatier, Toulouse, France)  
“Douady’s plan for a Julia set with positive measure”
- **Weixiao Shen** (University of Warwick, UK)  
“Puzzle geometry and rigidity for real polynomials”

### PROGRAM

	10:00 – 11:00	11:30 – 12:30	14:30 – 15:30	16:00 – 17:00
Thursday, Feb. 12	Shen	Chéritat	Shen	Chéritat
Friday, Feb. 13	Shen	Chéritat	Shen	Chéritat

This conference is a part of RIMS project “Complex Dynamics”. There will be a conference on “Complex Dynamics” next week in RIMS.

# 複素力学系の総合的研究

Complex Dynamics

## 研究集会

京都大学数理解析研究所の共同研究事業の一つとして、下記のように研究集会を催しますので、ご案内申し上げます。この研究集会は、平成15年度数理解析研究所プロジェクト「複素力学系」の一環です。

研究代表者 穴倉 光広 (京都大学 大学院理学研究科)

副代表者 木坂 正史 (京都大学 大学院人間・環境学研究科)

### 記

日時：2004年 2月16日 (月) 10:30～

2月20日 (金) 14:30

場所：京都大学数理解析研究所4階420号室

京都市左京区北白川追分町 (市バス 京大農学部前 または 北白川 下車)

## プログラム PROGRAM

2月16日 (月) Monday, February 16

- 10:30～11:30 Adrien Douady (Université de Paris-Sud, France)  
Conjectures about the Branner-Hubbard motion for an (almost) arbitrary Cantor set in  $\mathbb{C}$
- 13:30～14:30 Arnaud Chéritat (Université Paul Sabatier, Toulouse, France)  
Boundaries of quadratic Siegel disks
- 14:45～15:45 角 大輝 (東工大・理) [Hiroki Sumi (Tokyo Institute of Technology)]  
Dynamics of postcritically bounded polynomial semigroups and interaction cohomology
- 16:00～17:00 Peter Haissinsky (Université de Provence, France)  
Uniformization of rational maps

2月17日 (火) Tuesday, February 17

- 9:30～10:30 Jacek Graczyk (Université de Paris-Sud, France)  
On the Schwazian derivative
- 10:45～11:45 Weixiao Shen (University of Warwick, UK)  
Existence of SBR measure is typical in the family of unimodal polynomials
- 13:30～14:30 Konstantin Khanin (Newton Institute for Mathematical Sciences & Heriot-Watt University, UK)  
Renormalizations and rigidity for circle diffeomorphisms with singularities
- 14:45～15:45 奥山 裕介 (金沢大・理) [Yusuke Okuyama (Kanazawa University)]  
The value distributions and dynamics of rational iteration sequences
- 16:00～17:00 木坂 正史 (京大・人間・環境) [Masashi Kisaka (Kyoto University)]  
Construction of doubly-connected wandering domains

2月18日(水) Wednesday, February 18

- 9:30~10:30 Carsten Petersen (Roskilde University, Denmark)  
Rebirth of Receding limits
- 10:45~11:45 宇敷 重廣 (京大・人間・環境) [Shigehiro Ushiki (Kyoto University)]  
Eigenfunctions of complex Ruelle-operators for hyperbolic rational maps and Artin-Mazur's zeta-function
- 13:30~14:30 Xavier Gomez-Mont (Centro de Investigacion en Matematicas, Mexico & RIMS)  
Brolin-Lyubich like asymptotic measures for some Holomorphic Flows
- 14:45~15:45 Hossein Movasati (Georg-August-Universität Göttingen, Germany)  
Holomorphic foliations with a center singularity
- 16:00~17:00 Michael McQuillan (University of Glasgow, Scotland)  
Residue estimates & linear systems
- 18:00~ Dinner at Ganko Takasegawa Nijoen (がんこ 高瀬川二条苑)

2月19日(木) Thursday, February 19

- 9:30~10:30 Feliks Przytycki (Polish Academy of Science, Poland)  
Pressure and dimensions for rational maps
- 10:45~11:45 Genadi Levin (Hebrew University of Jerusalem, Israel)  
Estimates of the Hausdorff dimension of Julia sets of unimodal polynomials with highly degenerate critical points (joint work with Greg Swiatek)
- 13:30~14:30 稻生 啓行 (京大・理) [Hiroyuki Inou (Kyoto University)]  
limits of renormalizable polynomials
- 14:45~15:45 中根 静男 (東京工芸大学) [Shizuo Nakane (Tokyo Polytechnical University)]  
Non-landing of stretching rays for real cubic polynomials (Joint work with Yohei Komori)
- 16:00~17:00 諸澤 俊介 (高知大・理) [Shunsuke Morosawa (Kochi University)]  
Dynamics of complex error functions

2月20日(金) Friday, February 20

- 9:30~10:30 Mariusz Urbanski (University of North Texas, USA)  
Geometric and Invariant Measures for the Exponential Maps
- 10:45~11:45 川平 友規 (名古屋大・理) [Tomoki Kawahira (Nagoya University)]  
QC-perturbations of geometrically finite rational maps
- 13:30~14:30 Manfred Denker (Georg-August-Universität Göttingen, Germany & Kyoto University)  
Stochastic laws for rational maps

京都オープンスクール

## 複素力学系への招待

Invitation to Complex dynamics

日時：2003年12月8日（月）10:00～12月9日（金）16:30

場所：京都大学大学院理学研究科 数学教室 3号館 109講演室

京都市左京区北白川追分町（市バス 京大農学部前 または 百万遍下車）

### プログラム PROGRAM

12月8日（月）Monday, December 8

10:00～11:00 宍倉 光広（京都大学大学院理学研究科）  
複素力学系入門

11:30～12:30 John H. Hubbard (Cornell University & Université de Provence)  
The combinatorics of polynomials and the spider algorithm

14:00～15:00 John Milnor (State University of New York at Stony Brook)  
Generalized Lattès maps and mating

15:30～16:30 John H. Hubbard (Cornell University & Université de Provence)  
Exploring the parameter space of Hénon maps by software “Saddle-Drop”

12月9日（火）Tuesday, December 9

10:00～11:00 宍倉 光広（京都大学大学院理学研究科）  
マンデルブロー集合探訪

11:30～12:30 John Milnor (State University of New York at Stony Brook)  
Dynamical models for evolution

14:00～15:00 Eric Bedford (Indiana University & 数理解析研究所)  
Complex Dynamics in one and two dimensions

15:30～16:30 John Smillie (Cornell University & 数理解析研究所)  
The role of potential theory in complex dynamics in dimensions 1 and 2

このオープンスクールは、21世紀COE「先端数学の国際拠点形成と次世代研究者育成」（京都大学 数理解析研究所 および 京都大学大学院理学研究科 数学教室）および、数理解析研究所プロジェクト「複素力学系」の一環です。

数理解析研究所プロジェクト  
複素力学系  
Complex Dynamics  
2003年4月～2004年3月

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